SPONTANEOUS BREAKDOWN OF THE LORENTZ INVARIANCE IN THREE-DIMENSIONAL GAUGE THEORIES †

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ABSTRACT

In a class of renormalizable three-dimensional abelian gauge theory the Lorentz invariance is spontaneously broken by dynamical generation of a magnetic field B. The true ground state resembles that of the quantum Hall effect. An originally topologically massive photon becomes gapless, fulfilling the role of the Nambu-Goldstone boson associated with the spontaneous breaking of the Lorentz invariance. We give a simple explanation and a sufficient condition for the spontaneous breaking of the Lorentz invariance with the aid of the Nambu-Goldstone theorem. The decrease of the energy density by $B\neq 0$ is understood mostly due to the shift in zero-point energy of photons.

1. Variational Ground State

In a wide class of three-dimensional gauge theories described by 1,2

$$\mathcal{L} = -\frac{1}{4} F_{\mu\nu} F^{\mu\nu} - \frac{\kappa_0}{2} \varepsilon^{\mu\nu\rho} A_{\mu} \partial_{\nu} A_{\rho} + \sum_{a} \frac{1}{2} \left[\overline{\psi}_a , \left(\gamma_a^{\mu} (i \partial_{\mu} + q_a A_{\mu}) - m_a \right) \psi_a \right] ,$$
 (1)

the Lorentz invariance is spontaneously broken by dynamical generation of a magnetic field B. We have constructed a variational ground state which has $B \neq 0$ and has a lower energy density than the perturbative vacuum. The theory is renormalizable.

Taking advantage of charge-conjugation invariance of (1), one can take $q_a > 0$ without loss of generality. Chirality of a Dirac particle is defined by $\eta_a = \frac{i}{2} \operatorname{Tr} \gamma_a^0 \gamma_a^1 \gamma_a^2 = \pm 1$ (for $m_a \ge 0$). It is equivalent to the sign of m_a for $m_a \ne 0$ with $\eta_a = +$, as can be understood by making a transformation $\{\gamma^{\mu}\} \to \{-\gamma^{\mu}\}$.

[†] To appear in the Proceedings of PASCOS '94.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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MSW/HNS/lab 1982-129P

Attachment(s)

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Appl No: 09/374,989

Attorney Docket: 1982-129P

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Toru MATAMA Conf.: 4436

Appl No: 09/374,989 Art Unit: 1752

Filed: August 16, 1999 Examiner: Amanda Walke

For: PHOTOGRAPHIC PHOTOSENSITIVE MATERIAL AND

PHOTOGRAPHIC PRINTING SYSTEM

REPLY BRIEF

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

June 25, 2004

Sir:

In reply to the Examiner's Answer dated April 28, 2004, the following remarks are respectfully submitted in connection with the above-identified application as follows.

BOHAN DOES NOT AFFIRMATIVELY **PROHIBIT** BOTH MASKING COUPLER AND DIR COUPLER AT THE SAME TIME

Bohan et al. (USPN 5,837,433, hereinafter "Bohan") discloses a method of providing a color image using color silver halide emulsion layers which have chemical based color corrections by masking compounds and Development Inhibitor Releasing (DIR) compounds. Bohan discloses that a film may be digitally scanned and printed when digital processing occurs.

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The Examiner admits that Bohan discloses a color negative material which may include both masking coupler Development Inhibitor Releasing (DIR) couplers. See Examiner's Answer, page 4, lines 5-9. However, there is clearly no affirmative prohibition of both masking compounds compounds from being present at the same time. Therefore, by the Examiner's own admission, Bohan simply cannot teach or suggest that "said photographic photosensitive material does not contain a colored coupler for said color correcting function and a DIR coupler for said sharpness enhancing function at the same time."

In the Examiner's Answer, the Examiner asserts that Bohan provides examples of materials which only contain DIR couplers.

More specifically, the Examiner states:

... the first three examples of the [Bohan] reference demonstrate a material that only contains the DIR coupler. Masking couplers C2, C3, and C6, are not present in those exemplified materials. Thus, the reference clearly contemplates employing either the masking coupler OR the DIR coupler, and not solely both simultaneously. See Examiner's Answer, page 7, lines 12-15.

It appears that the Examiner is referring to Photographic Samples 1-3 in columns 24-26 of Bohan. The Examiner should note

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the description at column 25, lines 56-59 of Bohan. This description completely contradicts the Examiner's position that "Masking couplers ... are not present in those exemplified materials." See Examiner's Answer, page 7, line 13. Similarly, note column 26, lines 5-8 and lines 22-24. Clearly, some amount of color masking coupler is present in Photographic Samples 1-3, contrary to the position taken by the Examiner.

On the other hand, if the Examples to which the Examiner refers are the embodiments as shown in Figures 1-3 of Bohan, the Examiner's assertions are again factually incorrect. For example, the Examiner is incorrect with regard to the film structure of Figure 1. Bohan specifically teaches that layers 5, 6, and 7 typically include both DIR couplers and cyan dyeforming magenta and yellow masking couplers and that layers 9, 10, and 11 also typically include both DIR couplers and magenta dye-forming yellow masking couplers. See Bohan, column 11, lines 52-55 and 62-65.

The Examiner is also factually incorrect with regard to the film structure of Figure 3. Bohan teaches that layers 28 and 29 typically include both DIR couplers and yellow dye-forming cyan and magenta masking compounds and that layers 33, 34, and 35

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typically includes both DIR couplers and cyan dye-forming magenta masking compounds. See Bohan, column 12, lines 51-55 and column 13, 7-11.

More importantly, even if the Examiner's characterization is taken at face value, it still does not illustrate that Bohan affirmatively prohibits both the DIR and masking couplers functions being included at the same time.

The Examiner also relies on column 11, lines 16-26 of Bohan which states in part, "due to the inability of the art to provide adequate chemical based color corrections whether by masking compounds, or Development Inhibitor Releasing (DIR) compounds, such constraints are obviated by the digital scanning and color correction steps employed in specific embodiments of this invention." The Examiner relies on this statement and asserts that Bohan teaches use of one or both DIR and masking couplers, but not both.

In as far as the specifically relied upon portion is concerned, the Examiner has taken the statement out of context. Bohan specifically describes a problem in the art related to arranging a green or red light sensitive emulsion layer on one side of a film support and arranging a blue light sensitive

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emulsion layer on the opposite side. See Bohan, column 11, lines 9-15. Bohan specifically indicates that such an arrangement is avoided in camera films intended for optical printing due to the inability of the art to provide adequate chemical based color corrections. Thus, when interpreted in the proper context, the relied upon portion indicates that the avoidance of physically arranging red or green layer on one side of the support and blue layer on the other side is obviated.

Indeed, Bohan states, "It is additionally contemplated that either general or color specific digital image sharpening be applied." Thus, when read in proper context, it is clear that Bohan contemplates using chemical based color correction mechanisms using DIR and masking couplers and additionally using digital processing.

The Examiner further maintains that the material of Bohan includes a unique processing step. See Examiner's Answer, page 8, lines 3-4. Clearly, the processing step is not unique if both chemical or digital processing may be utilized for the same material. Thus, the Examiner's statement that "the bar code ... would include information about ... its unique

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processing information" cannot be true as well. See Examiner's

Answer, page 8, lines 4-8.

Further, the Examiner states that Appellant, in page 11,

line 16 of the Appeal Brief, admits Bohan is not required to

contain a DIR coupler. Appellant invites the Examiner to review

page 11, lines 15-17 of the Appeal Brief in which it is stated,

"The Examiner admitted Bohan discloses the photographic material

may contain an DIR coupler" and to lines 18-21 in which it is

stated, "The Examiner also readily admitted that Bohan discloses

photographic material may include color masking couplers."

Emphasis added. Clearly, the Examiner's characterization is not

accurate.

SUZUKI CANNOT TEACH IDENTIFICATION CODE

As the Examiner admits, Bohan fails to disclose, "a

material having a bar code in it or on the cartridge encasing

it." See Examiner's Answer, page 4, lines 9-10. To make up for

this deficiency, the Examiner relies on Suzuki et al. (USPN

6,094,218, hereinafter "Suzuki").

Suzuki discloses a film with magnetic storage regions and

bar code regions which may contain information limited to the

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type of film, frame number, total number of frames and the film

type. However, Suzuki teaches nothing with respect to providing

specific information about whether or not the "photosensitive

material has only one of or none of said color correcting

function and said sharpness enhancing function."

Also the Examiner simply takes the position that "since the

bar code of Suzuki et al may contain information relating to

photography with respect to type of film contained in the

cartridge, it would have been obvious to one of ordinary skill

in the art to encode useful information relating to all

photographic layers and additives therein." See Examiner's

Answer, page 8, lines 9-12. Simply taking a position cannot

substitute for the requirement of demonstrating proper

motivation to be found within the cited art as required in

M.P.E.P. 2143.01.

BOHAN AND SUZUKI NOT DEDICATED TO DIGITAL PROCESSING

The Examiner appears to be of the opinion that if a

material can be processed digitally, then it is dedicated to

digital processing regardless of whether the material is

designed for conventional chemical processing.

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As noted above, Bohan does not exclude conventional

processing to develop images. Indeed, it has been shown that

Bohan specifically contemplates digital processing in addition

to chemical processing. In short, Bohan's film structures are

not photographic photosensitive materials dedicated for digital

data processing.

The Examiner states that "The ENTIRE disclosure of Bohan et

al. references teaches and even requires that processing is not

complete until a final product that has been through development

processing AND digital processing is obtained." See Examiner's

Answer, page 9, line 22 - page 10, line 2. The logic appears to

be the following. Bohan teaches digitally processing a

photographic material to achieve a finished product. Therefore,

Bohan must teach a photographic material that is dedicated to

digital processing.

Appellant respectfully submits that the Examiner's logic is

faulty. Just because a material may be used in a particular

process is not conclusive evidence that the material is

dedicated for that particular process.

The Examiner also wrongly dismisses the inclusion of Pagano

et al. (USPN 5,543,882, hereinafter "Pagano") in Bohan. Bohar

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specifically discloses that photographic processing method and

apparatus described in Pagano may be utilized. See Bohan,

column 20, lines 39-42. Pagano is directed toward method and

apparatus of developing a film in a cartridge in which the film

is not detached from the cartridge while being processed. It

should be noted that the developing of the film itself is quite

conventional as described in Pagano. In other words, the film

may be developed via chemical methods.

The Examiner dismisses this inclusion of Pagano by simply

asserting that besides the particulars of the development

processing step/method, the teachings of Pagano are irrelevant.

See Examiner's Answer, page 10, lines 2-5. In other words, the

Examiner is simply ignoring the teachings of Pagano as a whole.

The Examiner also speculates that one of ordinary skill would

ignore the teachings of Pagano as well, which is clearly

unreasonable.

BOHAN AND NAIR DEFICIENT

The Examiner's reliance upon Nair et al. (USPN 5,723,426,

hereinafter "Nair") is similar to her reliance upon Suzuki. See

Examiner's Answer, page 10, line 8 - page 11, line 8. The

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combination of Bohan and Nair suffers from at least similar

deficiencies related to that of the combination of Bohan and

Suzuki.

BOHAN DISCLOSES CONVENTIONAL FILM STRUCTURE LAYERS

The Examiner states that Bohan "teaches that silver halide

material of the invention may contain any conventionally

employed layers." See Examiner's answer, page 11, lines 9-12.

Appellant fails to understand the significance of this statement.

Indeed, to the extent that Bohan teaches anything conventional,

it only bolsters the argument that Bohan may not be relied upon

to teach or suggest a photographic material dedicated to digital

processing and may not be relied upon to teach or suggest

prohibiting both masking and DIR couplers at the same time.

CONCLUSION

It is respectfully requested that the outstanding

rejections set forth in the Final Office Action be REVERSED.

If necessary, the Commissioner is hereby authorized in this,

concurrent, and future replies, to charge payment or credit any

overpayment to Deposit Account No. 02-2448 for any additional

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fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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